

[0036] Where an operator is equipped with a mobile operator kit, such as a Pocket PC[®] with a bar-code scanner, or other suitable handheld computer, in contrast to stationary computer stations, the operator can perform many different functions, including closed loop component validation, performance maximization, and others. The user has to log on to the manufacturing control system, before she/he can use it. Since there is one operator kit per operator, the login information can be used to check permission level in order to release objects and record the release information including the user information.

[0037] In another aspect of the present invention, the computer-controlled manufacturing system provides help to a user in deciding whether he/she wants to download the latest released version, a specific version or the latest unreleased version of an object, such as a recipe. This is accomplished by giving the user a choice in selecting a version to download, however, commensurate with her/his level of permission. With a minimum grant of permission, the user will only be able to select the latest released or validated version for that line to download. This will be the normal case for operators. Also, when selecting a recipe, the default is preferably the latest released or validated version. The availability of the newer, unreleased or partially released version is also made visible to the user. A partially released version is that which is validated for another line or released for another factory. The user then chooses to decide which version to select. It is also possible to select a previous version, if required.

[0038] An example of execution of an embodiment of the present invention, with the various events described above, is shown in Fig. 3. In the illustrated embodiment, without limitation, a one-line factory is programmed by one or more engineers. The engineer who programs the products (e.g., boards and machine instructions for assembly) is very often the same person running the line as well, or the person who prepares the set-up for the run. The engineer/operator, therefore, is knowledgeable about any changes and can make, validate and release versions of the program corresponding to those changes as he/she sees fit. Using Figs. 2a-2c also, where now Recipe-1 refers to the Board recipe and Recipe-2 refers to the line or setup recipe, it is seen that both objects with the names of board and mobile phone line take version V1.00 as they are newly created objects, even with changes made to the board on the way to release. Then, with a modification made to the form factor of a small outline transistor (SOT) 23 at event 11 in the same Fig. 3, the version numbers for both recipes 1 and 2 are incremented by 0.01 while the version number of the component is incremented by 1. And they are released at event 14 after the line asks for release and the engineer/operator does so after confirming the validity of the change. It will be appreciated that, for a single line, validation and release processes coalesce, as there is no other line to which the package can be released. As still another example, Fig. 3 shows that, when a different recipe for a different product using the same board is downloaded as Recipe-3, thus replacing the mobile phone with a handheld computer the version number for Recipe-3 is incremented in the

same manner as before by 0.01 if the form factor of a component downstream is modified. The version number of the component itself is incremented by 1, to V3.0 for the reasons given earlier. After checking the board for its integrity, the Recipe-3 and package form are released with the stated version numbers.

- 5 Since there was a change on the board, the system automatically updates recipes at the single line Enterprise level.

[0039] The case of version tracking in a multiple-line factory is shown in Fig. 4. Here, at a factory with several manufacturing lines, or at a globally distributed factory, or at an Enterprise with several factories, the engineer who is programming the board and machines is normally a different person from the one who is running the line and setting them up. Thus, the engineer and the operator are two different entities in Fig. 4, and it is only the process engineer who can release a program. However, until the release, the operator can download, modify and change objects and validate them, but only for his/her own line. The Engineer is notified automatically when a change has occurred (see event 37 in Fig. 4) and only he or she has the authority to release the modified package with a new version number to the rest of the lines in the factory, or to the lines distributed globally throughout the Enterprise. The intermediate incremental change by 0.01 due to the modification of the package form factor follows the same procedure as was the case in Fig. 3.